

particularly useful in certain lines of botanical research, especially in ecology where relative humidity readings must form the basis of a large part of the work. The one advantage of the machine is its compactness, making it easily portable with little danger of accidental breakage. Furthermore, the cost of construction is little more than the cost of a good pair of thermometers which should be 8 or 10 inches in length. If

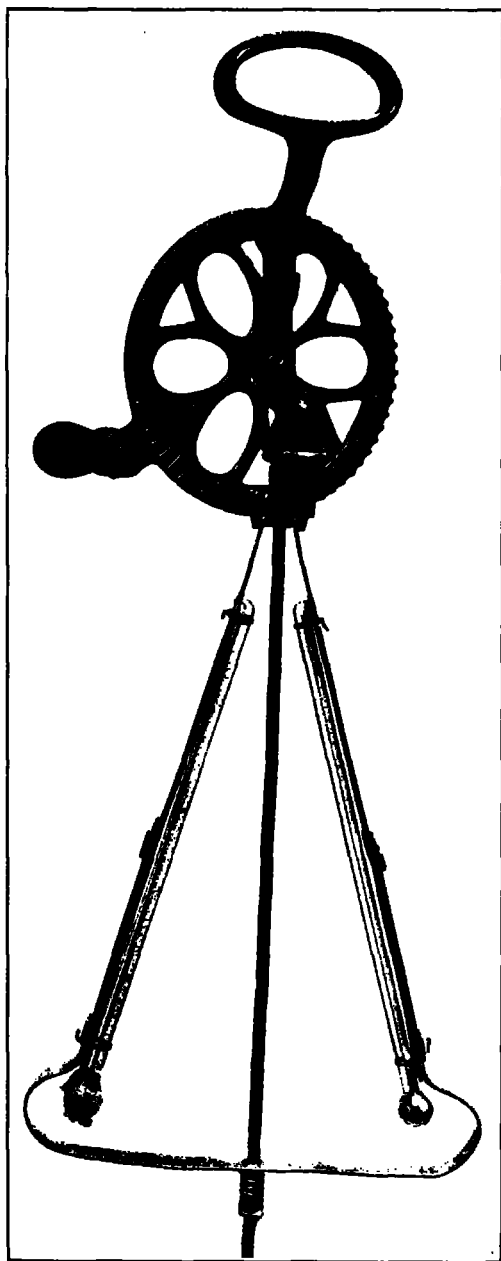


FIG. 1.—O'Gara's portable rotation psychrometer.

desired, the axis, around which the frame and thermometers turn, may be prolonged some distance beyond the end of the frame and rest against a tree or other fixed object while whirling. However, in order to insure accuracy in the results, the instrument should be moved about as much as possible, or as far as the space will allow, while it is being whirled. The writer has constructed several of these instruments and has found no difficulty in getting just as accurate readings as with the standard psychrometer now in use at the different Weather Bureau stations.

THE PSYCHROMETER: ROTATED, WHIRLED, VENTILATED.

The preceding article by P. J. O'Gara is welcome as showing that at least one of the modern improvements in psychrometry has been accepted by biologists, viz, the necessity of ventilation. There are other matters quite well worth considering. The formulas and tables devised by Ferrel and those used in both American and German weather bureaus are constructed for thermometers with cylindrical bulbs; appreciable changes in these tables are required if, as indicated in Mr. O'Gara's drawing (see fig. 1), spherical bulbs are used. This change is not wholly a question of convenience or sensitiveness, but arises from the differences in radiation, absorption, and evaporation between spherical and cylindrical surfaces. Anyone intending to use the published tables should provide himself with thermometers having cylindrical bulbs.

Mr. O'Gara has devised an arrangement that is safer and more convenient than the sling psychrometer for use close to the ground and in other contracted localities where the ordinary sling can not be used. Both this device and the sling are, however, inferior in accuracy to those forms of apparatus in which the thermometers are whirled in shelters or enclosed in separate tubes and the air drawn over them by some convenient method. Assmann uses a centrifugal fan attached to one end of the ventilation tube, and his fan may be driven by clockwork or electric motor. One could easily substitute a fan driven by hand or any other mechanical agency. All these details, however, involve increased cost and complication, and the O'Gara device is very good where results of the highest accuracy are not essential. If it is desired to ascertain the moisture in a very limited portion of air, we accomplish this by simply pointing the ventilation tubes into that air and working the fan. As the ventilation tubes protect the thermometer from radiation, Assmann's apparatus gives more correct temperatures and moistures than unprotected thermometers.

A high grade of thermometer is necessary in psychrometric work, since it is the difference between the dry-bulb and wet-bulb that enters the psychrometric tables, and this difference should be correct to within a tenth of a degree, an accuracy that is not attained by ordinary thermometers. The velocity of ventilation, or rotation of the thermometers, should be between 15 and 25 feet per second in order to harmonize with the velocities used in obtaining the data on which the standard psychrometric tables are based. The Weather Bureau tables are not applicable to the stationary unventilated wet-bulb thermometer with coarse cotton wick extending down to a vessel of water. In fact, that older form of psychrometer is too crude to give results at all comparable in accuracy with modern good methods.

From a meteorological, or a hygienic, or a biological point of view it is often of more importance to ascertain correctly the general condition of a large mass of air than the exact condition of a specific small mass. The former desideratum is best attained by using some form of rotating or whirling psychrometer freely exposed to the wind;¹ the latter is attained by using the form of psychrometer recommended by Belli and perfected by Assmann, which draws the specific mass of air directly past and close to the thermometer bulbs.

Still higher accuracy is of course attained by using some perfected form of dew-point apparatus, but this deals with a still more limited quantity of air that is temporarily in immediate contact with the bedewed surface.—C. A.

WEATHER BUREAU MEN AS EDUCATORS.

H. W. Grasse, Assistant Observer, Moorhead, Minn., reports that a class of 42 students from the Moorhead State Normal School visited the local office on January 19 and 20.

¹ Doctor Craig used a sling, but enclosed the thermometer in thin metallic tubes.